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Decision Support Models for Movies: Making Science out of an Art

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The summer of 2008 saw some record-breaking movie releases. *Batman* sequel, *The Dark Knight*, which opened to rave reviews in the US, set an opening weekend box office record of US$158.4 million. And it continued to rewrite the history books with four consecutive #1 weekends, and having surpassed the US$400 million mark in just 18 days.

On the other side of the world, John Woo's historical epic *Red Cliff* smashed all previous records in China with opening weekend box office takings of US$15.8 million. In comparison, Hollywood blockbuster, *Transformers,* took five days to break the US$15 million mark when it was screened on the mainland last year. *Red Cliff* also opened strongly in Taiwan, Hong Kong, Korea and Singapore, raking in US$25 million across Asia.

How can movie exhibitors, distributors and producers predict box office earnings in advance and apart from opening numbers, some good hunches and a lot of luck? At a recent seminar on 'Researching the Entertainment Industry' at the Singapore Management University, Josh Eliashberg, Wharton professor of marketing and operations and information management, presented a set of decision support tools developed with an international team of researchers, which could help "make a science out of an art", according to him.

The tools include a demand assessment model for forecasting attendance and a movie scheduling algorithm, whereby complex adjustments to macro and micro scheduling successfully demonstrated an actual profitability improvement between 4.7 % and 6.7%.

While work is ongoing to refine and customise the models to take into account variables such as demography, movie ratings and cinema locations, the initial findings indicate that models can supplement intuitive judgment by assisting in answering questions such as the period and frequency of movie screening, what schedules work best, and how many screens in a multi-screen cinema should a movie command.

Exhibitor's Macro and Micro Scheduling

The research team began by conducting retrospective analysis of movies scheduling and ticket sales over 27 weeks at the NYC Theatre. Using historical figures to predict future performance, Eliashberg and his colleagues employed forecasting and screening room optimisation methodologies. They demonstrated that there exists the potential for a 38% and 121% increase in net margin by playing movies for a longer run and by more carefully selecting the 'right' movies to show the local clientele, respectively.

To test the model in practice, it was implemented in collaboration with a major movie exhibitor in the Netherlands using experimental and control theatres. Instead of historical data, the team used data mining and up-to-date figures as the bases for forecasting and optimisation to enhance accuracy. The findings revealed that the use of the model by the exhibitor yielded higher net margin as compared with the theatre where scheduling decisions were based on pure judgment and intuition.

The team extended the model further to explore whether the numbers changed when micro scheduling was introduced. "We wanted to find out if we could forecast ticket sales on different hour screenings. The model must work within the many constraints set by the exhibitor, such as dissimilar movies starting and ending at the same screening times, no overcrowding, time out for janitorial services, and opening and closing times of the theatres," said Eliashberg.

Leveraging data mining and historical information to predict ticket numbers, the team reworked the screening times and choice of movies for multi-screen cinemas. The model was then refined using updated figures for the hour-based forecasts. The findings showed that micro scheduling did help improve the takings of the exhibitor.

Localising Decision-Making

Eliashberg noted that in the US and the Netherlands , where the team conducted their research, the exhibitor's movie scheduling decision-making is highly centralised. Decisions are made at the corporate level on which movies to screen at which locations and for how long, without sufficient understanding and analysis of local demand on the ground. However, centralised decision-makers are often out of touch with local movie-goers' preferences and, therefore, cannot always make the right decisions for different locations.

For example, corporate decisionmakers remove movies prematurely, giving in to the pressure from distributors to free up the screens for new movies. Such actions, in turn, curtail profits that might have been earned. This is where the decision models can make a difference, according to Eliashberg, as they help address these shortcomings objectively

and enhance the exhibitors' returns.

As consumer behaviour can differ significantly across locations, there is also a need to 'localise' the model before it can be implemented. In the US, for example, audiences consider movie titles more important than screening locations, while the reverse is true in the Netherlands. In mainland China, the involvement of a local big name or a focus on Chinese culture will drive up ticket sales, while Hong Kong is swayed by advertising and hype.

Eliashberg says that the model (SILVER SCREENER) will be further fine-tuned and customised for more detailed and improved forecasting. Perhaps it could answer such questions, in retrospect, as: Would *The Dark Knight* have remained in # 1 position instead of being displaced by *Tropic Thunder*? Would it have posed a more serious challenge to all-time favourite, *Titanic,* in terms of box-office takings? Or would *Red Cliff* have surpassed its own record-breaking US$15.8 million weekend takings?

Distributor's Perspective

While researching the film industry from the exhibitor's perspective, Eliashberg was tossed a challenge from the movie distributor to develop a model that could optimise marketing spend. "You know at Wharton we never say no," he quipped.

Using marketing resources that include movie, target segment, advertising material, media plan and distribution plan, Eliashberg and his colleagues tested the effectiveness of different marketing platforms. They developed and applied a different model, MOVIEMOD, a pre-launch forecasting and diagnosis system applied to motion pictures, which forecasts the weekly percentage of the target market that will attend the movie locally. Then, through regression, the model projects the cumulative domestic box-office performance. The model is based on breaking down the target market into sub-groups such as: Have not heard about the movie; Heard but waiting for an opportunity to watch it; Watched and Liked/Disliked it. The flows of consumers from one sub-group to another captures the dynamics of movie going behaviour observed in the real world.

Leveraging customer input, the researchers simulated the 'movie environment' for 140 respondents in Philadelphia. They tested the impact of an assortment of publicity tools including different permutations in advertisements, movie reviews, word-of-mouth and concept appeal.

The findings showed that word-of-mouth is critical. "WOM is free so distributors may be spending their money in all the wrong places," said Eliashberg. The model also showed that trailers and TV spots were effective, but, interestingly, placed movie critics far down the list. "Critics are not influential at all," says Eliashberg. "For instance, I always read the movie reviews on Friday and, if this particular critic pans the movie, I'd tell my wife, "Let's go watch this movie tomorrow". If he rates it highly, I won't watch it."

In terms of predicting attendance, MOVIEMOD was 9.3% off the actual attendance mark. Nevertheless, Eliashberg is sure that "it's still a better percentage error than any other forecast in the market."

back to top (#top)

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